AMENDMENT TO THE SPECIFICATION

Please amend the specification by marked up replacement paragraphs as follows.

Please replace the paragraph beginning at page 4, line 10, with the following rewritten paragraph:

Preferably, in the adjusting step, the cross-sectional shape of the blank pipe is adjusted to a predetermined shape including a circular or irregular cross-sectional shape. In the invention, an insertion of the mandrel causes the metal to be flown into the toothed die, resulting in a formation of a rack bar. In this formation process, the metal at the inner diameter side at the ends of the axial movement is likely flown to freed areas of reduced distance and of reduced flow resistance in a length wise or tooth width direction rather than flown into the toothed die, so that an amount of the metal in the die is likely lacked, resulting in a reduction of the precision of the product (rack bar). According to the present invention, prior to the insertion of the mandrel, an adjustment of the cross sectional shape (a cross-sectional area or inner or outer diameter) of the blank pipe to a predetermined shape is done. As a result, a local increase in thickness is obtained, which prevents a metal flow from being lacked at a desired location. Namely, a compensation of a metal flow amount is done, resulting in a desired precision of the product. In a certain situation, a metal expansion is not necessarily [[be]] even along the entire width. Namely, a reduced tooth width is enough if it is sufficient to mesh with a pinion to obtain a desired force transmission. As a result, it is quite usual that the toothed die has, at its sides along the tooth width, an opened structure. However, by this opened structure, an increased amount of metal is wasted in the direction of the width the metal flow, resulting in a reduced meshing force of the rack bar with a pinion. According to the present invention, a control of the cross-sectional shape of blank pipe is executed by ironing process prior to the rack bar forging, so that a non-uniform cross-sectional shape of the blank pipe is obtained. In other words, a thickness of the blank pipe is locally

increased at ends along the length and width, thereby obtaining a desired flow of metal even at the end zone of the die. Thanks to the non-uniform cross-sectional shape, an adaptation to a desired change in the toothed portions becomes possible when a rack bar of a miter gear type or VGR type is to be produced, in which a teeth pitch as well as a tooth width are varied. Furthermore, non-uniform cross-sectional shape according to the present invention is such that a shortage of metal flow at opened ends in the direction of axis and/or a shortage of metal flow at ends of tooth width direction is cancelled. In short, due to this solution of the irregular shape, a uniformly compensated flow resistance of the metal is obtained irrespective use of a single uniform shaped mandrel. In short, according to the present invention, a reduced operating force, an increased service life, an increased precision as well as an increased meshing efficiency are obtained, without using a plurality of irregularly shaped mandrels.

Please replace the paragraph beginning at page 5, line 34, with the following rewritten paragraph:

According to another aspect of the present invention, a method is provided for forging a hollow rack bar from a metal blank pipe, said method comprising a pre-forming step and a main forming step after the execution of the performing step, the pre-forming comprises the steps of:

(a) subjecting the blank pipe to swaging process for reducing the diameter of the blank pipe;

(b) clamping the swaged blank [[pip]] pipe by a clamping die of a desired shape at the outer periphery thereof, while locating an operating head inside the blank pipe, and;

(c) withdrawing the operating head so that the blank pipe is swaged at it inner diameter side, thereby generating a desired shape of the hollow cavity of the blank pipe extending in an axial and radial directions; and

said main forming comprises the steps of:

(d) holding the pre-formed blank pipe from its outer side by a rack forming die having toothed portions; and

(e) inserting, under a pressure, a mandrel to the inner diameter cavity of the blank pipe, thereby forming on the outer surface of the blank pipe toothed portions having shapes corresponding to those of the rack forming die.

Please replace the paragraph beginning at page 6, line 28, with the following rewritten paragraph:

According to the further another aspect of the invention, a method is provided, for forging a hollow rack bar from a blank metal pipe, comprising the steps of:

(a) holding said blank pipe by means of a ~~cramping~~ clamping die having, at its inner periphery, toothed portion for forming the rack, and;

(b) inserting, at a pressure, a mandrel into the blank pipe, while, during the insertion, the mandrel causes the metal to be subjected to simultaneous expanding functions at different locations of the toothed portions along the longitudinal direction, thereby forging the blank pipe to a hollow rack bar.

Please replace the paragraph beginning at page 8, line 11, with the following rewritten paragraph:

According to a further aspect of the present invention, an apparatus is provided, for forging a hollow rack bar from a blank metal pipe, comprising:

a die for holding the blank pipe;

a holder for a piece on which toothed portions are formed, and;

a mandrel for inserting, at a pressure, into the blank pipe held by the die, said mandrel being for forging the metal blank so that toothed portions corresponding to the shapes of the toothed portions of the die are formed on the blank pipe, thereby forming a rack bar;

said holder having an opening there-through, to which said toothed portion forming piece is embedded.

Please replace the paragraph beginning at page 8, line 24, with the following rewritten paragraph:

In an operation [[of]] for this aspect of the present invention, the holder is provided with an opening there-through as for embedding the toothed forming piece into the holder, which is effective of obtaining an increased working precision, resulting in an increased uniformity in the load applied to the toothed die. Thus, a prolonged service life of the working tool [[a]] as well as an increase precision of the toothed portions of the forged products are obtained.

Please replace the paragraph beginning at page 10, line 14, with the following rewritten paragraph:

Now, a process for forming or forging a rack bar, according to the present invention, will be explained. First, blank pipes are subjected to a process for obtaining a desired cross-sectional shape. Namely, in blank pipes from steel pipe makers, outer and inner diameters of these blank pipes are largely varied in ranges of a tolerance regulated under a government regulation, such as Japanese Industrial Standard (JIS). Due to such a large variation in outer and/or inner diameters, these blank pipes are far from desired ones so long as their cross-sectional shapes are concerned, which causes a precision of products (rack bars) to be reduced on one hand, and, on the other hand, causes a service life of tools, such as a die as well as a forging mandrels to be greatly

reduced. According to the present invention, a preliminary plastic deformation process including [[a]] swaging and ironing is newly provided for obtaining a desired cross-sectional shape of the blank pipe. A detail of such a preliminary process will now be explained. Namely, in Figs. 1A to 1E, a reference numeral 10 denotes a blank pipe made of [[a]] steel, and 12 a die of a ring shape for a swaging. In Fig. 1A, the blank pipe 10 is held by a suitable holding means (not shown) and, then, the swaging die 12 is moved in the direction as shown by an arrow a. Fig. 2B illustrates a condition, where the die 12 has completed its designated movement, so that a reduction of an outer diameter of the blank pipe 10 to that corresponding to an inner diameter of die 12 is obtained. Then, a return movement of the die 12 in opposite direction is occurred as shown by an arrow a'. A reduction (swaging) of the outer diameter of the blank pipe is thus completed.

Please replace the paragraph beginning at page 12, line 8, with the following rewritten paragraph:

From an opened condition of the die unit, a relative movement obtained between the upper and lower half dies 16-1 and 16-2, in such a manner that these half dies 16-1 and 16-2 are combined or closed as shown in Fig. 1D. At the closed condition of the die unit, the blank pipe 10 in contact with the half dies 16-1 and 16-2 is subjected to a reduction in its outer diameter. Fig. 2A illustrates cross-sectional shapes of the upper and lower half dies 16-1 and 16-2 at a middle location along the length of the die unit. As shown in Fig. 2A, both of the upper and lower half dies 16-1 and 16-2 have inner surfaces 16-1a and 16-2a of semi-circular cross-sectional shapes. These inner surfaces 16-1a and 16-2a cooperate to form a working cavity when the upper and lower dies 16-1 and 16-2 are combined. Fig. 2B illustrates cross-sectional shapes of the upper and lower half dies 16-1 and 16-2 at an end along the length of the die unit 16. As shown in Fig. 2B, the lower half die 16-2 has an inner surface 16-2b of a semi-circular shape.

Contrary to this, the upper half die 16-1 has an inner surface 16-1b of an irregular cross-sectional shape. Namely, the inner surface 16-1b of the upper die 16-1 [[has are]] is recessed at upper side portions in the transverse cross-section as shown in Fig. 2B. In this embodiment, the die unit 16 has an irregular cross-sectional shape only at the ends 16-1b of the upper die along its length. However, it is, of course, possible that the working cavity of the die unit 16 may has irregular cross-sectional shape along the entire length of the portion of the blank pipe, which is to be subjected to the ironing process.

Please replace the paragraph beginning at page 14, line 31, with the following rewritten paragraph:

Figs. 3 to 7 illustrates rack forging die unit 18 from a blank pipe 10 after subjected to the preliminary adjusting process as explained above. The rack forming die unit 18 includes an upper die 20 and a lower die 22. The upper die 20 is provided with a supporting member 24, a holder 26, a toothed piece 28, a lock piece 30, and push out pins 32 and 33. The toothed piece 28 is, at its lower surface, toothed portions 28-1, which have shapes corresponding to toothed portions of rack bar to be formed on a blank pipe 10. Fig. 7A illustrates a plan view of a rack bar 34 forged from the blank pipe. The [[lack]] rack bar 34 to be forged from a blank pipe 10 is, in this embodiment, of a type having skewed toothed portions 34-1. Thus, as shown in Figs 3 and 4, the toothed piece 28 is formed with skewed toothed portions 28-1, which correspond to the skewed toothed portions of a rack bar to be forged from a blank pipe. The holder 26 is fixed to the supporting member 24 by any suitable fixing means. Furthermore, the holder 26 is formed with an axially elongated opening 26A, to which the toothed piece 28 is received. The toothed piece 28 is inserted to the opening 26A via a liner 35. Furthermore, under the condition that the toothed piece 28 is installed to the elongated opening 26A as shown in Fig. 3, the toothed portions 28-1

at the bottom of the toothed piece 28 is slightly projected from the holder 26 and the locking members 30 are struck into gaps between the toothed piece 28 and faced inner walls of the holder 26. The lock member 30 has a tapered shape, so that the striking of the lock pin 30 causes a wedging function to be generated, resulting in the toothed piece 28 to be firmly held by the holder 26. The holder 26 is formed with cylinder bores 26-1, to which the ejecting pins 32 and 33 are respectively slidably inserted. The ejecting pins 32 and 33 are extended or retracted by a selective change in the direction of introduction of a fluid pressure into the cylinder bores 26-1. Namely, an expansion of the ejecting pins 32 and 33 allows a forged article, i.e., a rack bar to be removed. Although the pins 32 and 33A are hydraulically operated ones, any sealing members can be eliminated, which makes the total system to be simplified. Some hydraulic lines for connecting the cylinder bores 26-1 with a hydraulic pressure source as well as a control valve(s) for switching a communication of the hydraulic pressure source with the cylinder bores 26-1 are needed for obtaining the desired expansion and/or retraction operation of the pins 32 and 33. However, these parts are conventional and, therefore, are not shown in the drawings for the sake of simplicity.